Abstract of Thesis

In urban areas, the day to day increase in vehicular traffic in addition to the industries has provided the impetus for comprehensive monitoring and modeling of air quality. In the present study, Oxides of Nitrogen (NO_X) emissions from vehicular traffic as area sources and power plant/industries as point sources are considered. An air pollution dispersion model (AERMOD) is used for the assessment of NO_X dispersion over inland (Nagpur) and coastal (Visakhapatnam) urban regions of India during winter and summer months. AERMOD requires surface as well as upper air meteorological observations and various planetary boundary layer (PBL) parameters with good temporal resolution as input and are mostly not available over India. To fill this gap, a high resolution mesoscale atmospheric model (WRF) was employed and sensitivity experiments of five PBL parameterization schemes of WRF are conducted and the model results are compared with the available observations. It is noticed that Yonsei University (YSU) and Mellor-Yamada-Janjic (MYJ) schemes over Nagpur region and YSU and Asymmetric Convective Model version 2 (ACM2) schemes over the Visakhapatnam region have shown better performance. An offline coupler is developed to provide the required meteorological as well as other PBL parameters from the WRF simulations to AERMOD. The gridded emission inventory of NO_X by using exhaust emission from vehicles was prepared over the study regions with 1 km X 1 km grid resolution to serve as input for AERMOD for predicting the dispersion of NO_X concentration. The model predicted NO_X concentrations are compared with the available observations over the study regions. Analysis of the results reveals that meteorological data generated by YSU, predicted the GLCs of the NO_X closer to the observations over Nagpur and ACM2 scheme over Visakhapatnam for both summer and winter months. The deteriorated air quality pockets (hotspots) over both regions based on the modeled NO_X concentrations are identified. An attempt has been made to assess the NO_X concentrations in futuristic GLC emission scenarios. Based on the overall validation evaluation, the offline coupled WRF-AERMOD modeling system has shown better representation of air pollution dispersion and given confidence for its utility in the air quality assessment.

Key words: WRF model, Planetary Boundary layer, AERMOD model, emission inventory, Air quality